

## **UPPER ANIMAS RIVER BASIN ACID MINE WATER REMEDIATION:**

### **THE PROJECT PROPOSAL** – Submitted September 11, 2015

#### **SYNOPSIS**

The August 5<sup>th</sup>, 2015 breach and failure of the Gold King Mine adit dam is a tragic example of the legacy of Colorado's mining industry and technical challenges in the long term remediation of these mining districts. Mine reclamation is often done in a piecemeal fashion, addressing localized symptoms of the larger scale remediation problem. The developed solutions often do not treat the root of the problem and do not adequately consider the connection between adjacent mine works and interactions between groundwater, mine water and surface water. The lack of a systematic approach leads to non-optimized, expensive and even potentially dangerous remediation programs.

The scale and extent of mine development in many of Colorado's historic mining districts, including the San Juan complex, requires a new paradigm for remediation design and implementation. The goal is to collect the scientific understanding of the area, and utilize this information to transition from investigation and ad hoc remediation, to a fully-integrated, watershed-scale, science-based remediation program. Geoengineering projects of this scale should include the development of an integrated, full scale "systems models" of the regional scale hydro-geo-chemical system. These models allow for the quantitative evaluation of different remediation alternatives, prediction of the watershed scale system response, and the ability to choose the safest, cleanest and most economically efficient method of remediation.

This program will push the technical, regulatory, organization and legal boundaries, serving as a pilot project and providing a road map for future large scale remediation programs. The organizational and technical tools developed during this project can be refined and applied in mining complexes across America, allowing for a significantly reduced cost of remediation and a minimization of the risk of future environmental disasters.

## FOUR PHASE REMEDIATION PLAN

We propose to develop a cutting-edge approach for regional scale mine remediation in response to the recent mine discharge on the Animas River from the Gold King Mine in the Cement Creek Drainage near Silverton, Colorado. Our program is based on a multi-pronged, phased methodology:

- #1 Addressing the requirement for immediate water quality improvement;
- #2 Developing the long term cost effective solutions for the regional problem through the integration of existing and future research and the development of an optimized geological engineering remediation plan.
- #3 Construction of geological engineering remedies and excavation of waste.
- #4 Long Term Systems Model Monitoring of Abandoned Mines

### Phase #1 – The Water Treatment Plant

The Cement Creek drainage contributes a significant portion of the total metal load to the Upper Animas drainage. Efforts to reduce this load are what eventually led to the Gold King disaster, highlighting the immediate need to reduce metal loads to Cement Creek. Rapid water quality relief will be achieved through:

- Mine discharge collection;
- Water treatment.

Phase #1 proposes a water treatment facility constructed to treat water on Cement Creek downstream of the collected mine drainage. This water treatment facility will then become a tool for utilization in the long term remediation plan.

### Phase #2 – Hydro-Geological Engineering Plan

Long term resolution of the mine waste problem should be addressed through development of a *regional remediation systems model* and remediation plan. These models represent the final crucible for the collection and integration of the expert knowledge in the area, and will be informed by scientific studies which currently exist; continued site characterization and study; and a long-term monitoring system, implemented from the beginning of the remediation effort. These models will be used to predict system response to different remediation strategies and technologies, calculate the environmental benefit and economic costs and quantify the uncertainty of responses.

### **Phase #3 – Implementation of Geological Engineering Models**

Implementation of the regional remediation plan utilizing a variety of methods and techniques including:

- a) Installation of a monitoring network;
- b) Bulk heading the mine portals;
- c) Development of passive water treatment methodologies
- d) Removal of mine waste sites which threaten the watershed.

### **Phase #4 – Long-Term Monitoring Program**

In order to avoid future disasters and improve systems model predictions, a carefully planned long-term monitoring program is needed. Systems models can be used to assess the most important information needed to improve predictions, and the most important remediation aspects, thus guiding future scientific study and technology development.

During this phase scientists and engineers can monitor, assess, evaluate and predict hydrogeochemical changes and evolution. The goal is to predict system response and evaluate remediation outcomes and prevent future catastrophic events. Through time and the accumulation of data, the prediction of water amounts and flows will become more refined maximizing the safety of the Animas River Basin.

## **BUDGET**

### **PHASE NUMBER 1 – WATER TREATMENT PLANT**

Construction of a water treatment facility for the acid mine drainage located in upper Cement Creek. Request is for **\$15,000,000** based on amounts from MWH Report and adjusted for anticipated change in costs over time and costs associated with remoteness.

Establishment of a fund to operate the water treatment facility. Request is for **\$15,000,000** in Trust to capture interest of approximately \$1.2 million to operate the plant in perpetuity.

## **PHASE NUMBER 2 – HYDRO-GEOLOGICAL ENGINEERING PLAN**

Adequate funding to develop and complete a regional scale geological engineering remediation plan. Remediation plan development and optimization - **\$20,000,000**;

## **PHASE NUMBER 3 – Implementation of Geological Engineering Models**

Operational mining related remediation projects within the Upper San Juan Basin.

Request is for **\$35,000,000** allocated as follows: Draining Mine Portals - \$16,000,000; Bulk heading of identified high risk mine portals - \$14,000,000; Mine Waste Piles excavation and removal - \$5,000,000;

## **PHASE NUMBER 4 – LONG-TERM MONITORING PROGRAM**

Long term monitoring program - **\$6,000,000**

Adequate funding to identify and address any mine portal with the potential to cause a catastrophic blowout \$2,500,000. Ongoing scientific monitoring \$2,500,000; maintenance on existing remediation - \$1,000,000.

The totality of the economic impacts on San Juan County and the small Town of Silverton during this remediation project have not been calculated or included in this request. *We believe it is a far higher priority to immediately request the disaster relief dollars associated with this event.* We will address the economics later.

## **Science Sources Contributing to This Analysis and Proposal**

1. Peter Butler, PhD Hydrology and Public Policy, Animas River Stakeholders
2. Tom Casadevall, PhD Geology; Geologist Emeritus, USGS
3. Payton Gardner, PhD Geophysics; Professor of Hydrogeology, U of Montana